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MARKETS FOR SWEETENERS

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## MARKETS FOR SWEETENERS

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### INTRODUCTION

The most important trend in the sweetener industry since World War II has been the growing importance of sweeteners other than sugar. Sugar remains the most important sweetener, by a wide margin, but it has lost some ground, particularly in such products as soft drinks, canned fruits, and ice cream.

The sale and distribution of sweeteners in the United States differs in many ways from that of most farm products. For instance, the more important sweeteners (measured by volume of sales) commonly available to consumers in this country are carbohydrate foods produced by farmers, but they are meeting increased competition from noncaloric substances with no nutritive value manufactured largely by the chemical industry. This situation appears to be akin to the competition between animal and vegetable fats, or between these two types of fat and nonorganic materials used in the manufacture of detergents.

An increasingly large proportion of sugar and an even larger proportion of the other sweeteners are delivered to industrial food processors, where they become raw materials in the manufacture of a wide variety of consumer items. Here, in many cases, they tend to lose their identity and the consumer is frequently unconcerned with their presence. This is in sharp contrast to a product such as meat, which is largely marketed through retail stores and which seldom loses its identity in the consumer's mind.

Another distinctive characteristic of the sweetener industry is that the domestic production, imports, and marketing of sugar, the principal sweetener, has been regulated since 1934 by a system of quotas established by the Federal Government. Other farm crops have been subject to Government regulations affecting production and prices for about as long as sugar, but the sugar regulations have differed materially from those for other programs. The Government determines the total quantity of sugar that may be marketed during a year or other period of time and then divides this quantity among producing areas, domestic and foreign.

The most important change in the marketing of sweeteners in recent years has been the increasing competition between sugar and other sweeteners. The final effects of this are not yet fully apparent, but developments to date indicate a significantly slower increase in the use of sugar in the years ahead than would otherwise have been expected.

### PRODUCTS OF THE INDUSTRY

Until recently, few people in the United States thought of the sweetener industry as involving any products of economic importance except sugar. Sugar is still the dominant sweetener but the corn (corn sirup and dextrose) and noncaloric sweeteners (chiefly saccharin and cyclamate) have been increasing in relative importance, particularly in the last 3 or 4 years.

Sugar is a carbohydrate which is present in nearly all growing plants at some stage of their development. However, practically all the world's commercial sugar is obtained from either sugarcane or sugarbeets. Currently, sugarcane provides about 58 percent of the world's sugar supply and three-fourths of the quantity consumed in the United States. The chemical name for sugar is sucrose.

The corn sweeteners--sirup and dextrose--are derivatives of cornstarch, although similar products can be produced from any starch and, in the United States, some are produced from grain sorghums. Starch is a polymer, the molecules of which can be broken down to simpler carbohydrates. If the process is carried to completion, the end product is dextrose. If the process is stopped before completion, a sirup containing varying proportions of dextrose and other carbohydrates is obtained. The quantity, dry weight, of corn sweeteners used in the United States in 1963 was equal to about 14 percent of the total sugar and corn sweeteners used.

The principal noncaloric sweeteners used in the United States are saccharin, cyclamate, and mixtures of these. They are products of the chemical industry which have no nutritive value and are used primarily because of their taste and lack of calories. Cyclamate is 30 to 40 times as sweet as sugar, and saccharin about 300 times as sweet as sugar. They are used for dietetic and economic reasons.

A number of caloric sweeteners of minor economic importance are produced in the United States, including honey, maple sirup, cane sirup, sorghum sirup, and various edible molasses. Honey is the most important and the only one for which consumption has been increasing in recent years. These minor products are not discussed in this report.

## SUGAR

### The U.S. Sugar Quota System

The U.S. sugar quota has been a major factor in the changes which have occurred in the production and marketing of sugar since 1934. Before 1934, the United States maintained a tariff on imported sugar which provided some protection to the domestic industry; the degree of protection depended on the amount of the duty, which varied substantially from time to time. Also, the effectiveness of the duty, so far as sugarbeet and mainland sugarcane growers were concerned, had been lessened by the addition of areas from which sugar could be shipped to the continental United States free of duty. The most important dates in this expansion of duty-free areas are Hawaii, 1875; Puerto Rico, 1902; and the Philippines, 1914. Sugar from Cuba received a 20-percent tariff preference beginning in 1903.

These developments, at times, did more to encourage increased sugar production outside the continental United States than on the mainland. This was particularly true in the 1920's, when rates were nearly doubled in three successive laws, culminating with the Smoot-Hawley tariff of 1930. The Philippines had the most rapid increase in production of sugar from 1920 to 1934 of any area from which the United States received significant quantities. Partly because of this situation and partly because of the serious worldwide depression of all business activity, new ways of protecting producers in domestic areas were proposed, which also would be acceptable to Cuba, the principal foreign source of supply.

These proposals resulted in the passage of the Jones-Costigan Act, sometimes referred to as the Sugar Act of 1934. Although this law has been revised numerous



times, and many changes in detail have been made, the basic concept and means of control have not been altered. The law directs the Secretary of Agriculture to determine for each calendar year the sugar consumption requirements of the United States. It provides the Secretary with only general guidance for determining consumption requirements: "Determinations shall be made so as to protect the welfare of consumers and of those engaged in the domestic sugar industry by providing such supply of sugar as will be consumed at prices which will not be excessive to consumers and which will fairly and equitably maintain and protect the welfare of the domestic sugar industry." The Secretary, however, is authorized to make such changes in his determination of consumption requirements during any year as he deems necessary.

The law also specifies the formula to be used by the Secretary in dividing the consumption requirements among the various domestic areas and foreign countries.

In administering the Sugar Act, the Secretary exercises considerable influence over sugar prices and indirectly over the prices of other sweeteners.

### Shifts in Sources of Supply

The United States produces part of its sugar domestically and imports the remainder. In recent years, there have been important shifts in the relative quantities of sugar obtained from these two sources (table 1).

The most marked change has been the discontinuance, since 1960, of supplies from Cuba and accompanying increases in supplies from a considerable number of other countries. The proportion coming from domestic areas also has increased. This has been accomplished by a rapid increase in supplies from the sugarbeet and mainland sugarcane areas. Changes in supplies from Hawaii, Puerto Rico, and the Virgin Islands have been minor. Production in Hawaii was unusually low because of a strike in 1958. The 1961-64 supply from Hawaii was about normal.

### Changes in Production

These changes in sources of supply have been accompanied by shifts in acreages, in yields, and in the number of growers in each producing area in the United States (table 2). For instance, the annual output of beet sugar increased rapidly. Beet sugar was produced on substantially fewer farms, with higher yields per acre.

Trends in the mainland sugarcane area, were similar. However, there were fewer production changes in the principal offshore domestic areas.

Average grower receipts per farm from the sale of sugarbeets doubled between 1948-52 and 1958-62. This was almost entirely the result of the increase in acreage and yield per acre, since the average price received per ton of beets increased only about 2.5 percent. The share of Government payments in total grower receipts declined slightly, as rates of payment remained constant.

Average receipts per farm of sugarcane growers in the mainland area were more than twice those of beet growers, largely because much of the sugarcane in Florida and Louisiana is grown by a few corporations with very large acreages. The rate of increase in average receipts per farm from 1948-52 to 1958-62 was greater in the mainland sugarcane areas than in the sugarbeet area. In Puerto Rico, the effect of fewer farms was largely offset by the decline in sugar production, so that the change

Table 1.--Changes in U.S. sugar supplies following the 1960 embargo on sugar from Cuba

Source of supply	Average 1957-59		Average 1961-64	
	Raw value	Percentage	Raw value	Percentage
	<u>1,000 tons</u>	<u>Percent</u>	<u>1,000 tons</u>	<u>Percent</u>
Domestic beets.....	2,182	24.0	2,672	27.4
Mainland cane.....	832	7.0	877	9.0
Hawaii.....	881	9.7	1,067	11.0
Puerto Rico.....	898	9.9	852	8.7
Virgin Islands.....	11	.1	14	.1
Total domestic.....	4,604	50.7	5,482	56.2
Cuba.....	3,264	35.9	0	0
Philippines.....	955	10.5	1,242	12.8
Dominican Republic.....	78	.9	549	5.6
Peru.....	88	1.0	451	4.6
Mexico.....	59	.6	489	5.0
Brazil.....	0	0	338	3.5
Australia.....	0	0	170	1.7
Other.....	35	.4	1,039	10.6
Total foreign.....	4,479	49.3	4,278	43.8
Total.....	9,083	100.0	9,760	100.0

in average receipts per farm was moderate, although receipts were lower in 1953-57 than in either the earlier or later period.

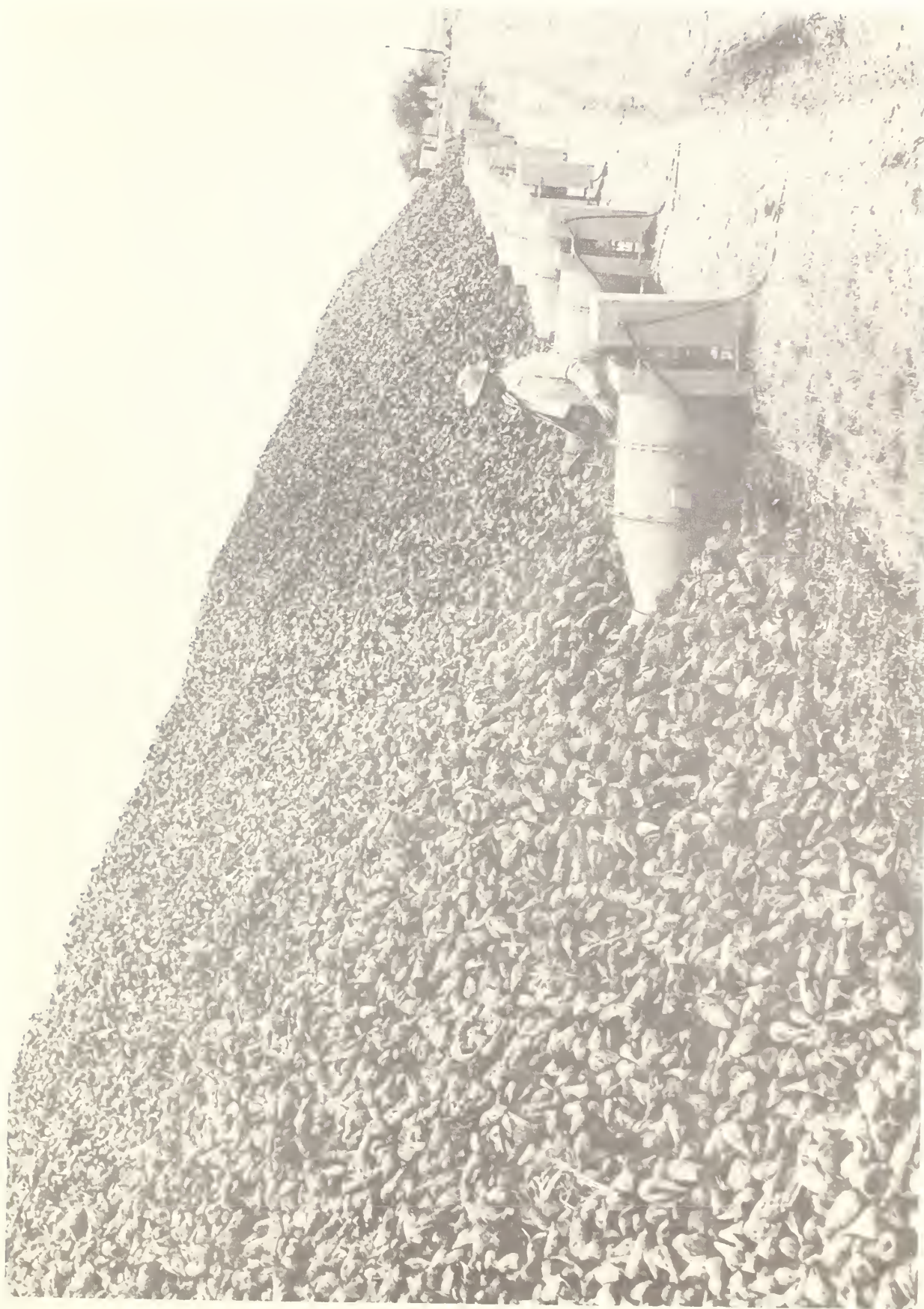
Since 1950, the number of man-hours required to produce the beets or cane necessary to yield 1 ton of sugar was substantially reduced in all producing areas in the United States (fig. 1). This is largely the result of increased mechanization--better machines for planting, cultivating, and harvesting--although better varieties, the use of more fertilizer, and improved chemical control of insects and weeds also have been important. The use of improved machinery also has been a major factor enabling an individual operator to increase his acreage of cane or beets.

#### Sugarbeet and Sugarcane Grower-Processor Relations

Practically all the sugarbeets produced in the United States are grown by farmers who sell their beets to a processing company. They are grown under the terms of contracts between growers and processors. These contracts customarily specify the acreage to be planted, require the grower to use seed purchased from the processor, and list certain requirements concerning the planting, cultivating, fertilizing, and harvesting of the beets.

Grower-processor contracts provide for determining the price growers are to receive for their beets. In most cases, the price per ton of beets varies with the net returns (price minus marketing costs) received by the processor from the sale of sugar--but not of byproducts--and with the sucrose content of the beets. These variations commonly are specified in a table showing prices per ton of beets for





Sugarbeets in storage awaiting processing. Ventilation tubes help prevent spoilage.

Table 2.--Sugar production trends in the United States, 1948-63

Items	Unit	Average 1/			
		1948-52	1953-57	1958-62	1963
Farms growing sugarbeets or sugarcane:					
Beet area.....	Number	30,239	25,412	24,397	22,807
Mainland cane.....	do.	5,192	3,785	2,854	2,419
Hawaii.....	do.	362	846	871	612
Puerto Rico.....	do.	17,021	18,268	14,131	12,317
Virgin Islands.....	do.	528	384	219	129
Harvested area per farm:					
Beet.....	Acre	24.2	31.8	40.6	54.7
Mainland cane.....	do.	64.7	77.3	126.6	192.3
Hawaii.....	do.	296.1	120.6	153.5	175.0
Puerto Rico.....	do.	23.6	21.2	25.6	27.5
Virgin Islands.....	do.	7.7	12.9	20.5	33.2
Yield of beets or cane:					
Beet.....	Ton	14.7	16.6	17.2	18.7
Mainland cane.....	do.	20.5	24.4	24.7	29.9
Hawaii.....	do.	76.4	89.0	87.5	93.4
Puerto Rico.....	do.	29.4	27.6	31.5	33.4
Virgin Islands.....	do.	19.3	24.4	24.6	36.3
Sugar produced, raw value:					
Beet.....	1,000 tons	1,559	1,957	2,404	3,086
Mainland cane.....	do.	516	580	707	1,183
Hawaii.....	do.	954	1,100	978	1,101
Puerto Rico.....	do.	1,276	1,089	1,043	1,004
Virgin Islands.....	do.	8	12	11	16
Grower receipts from beets or cane, per farm 2/:					
Beet.....	Dollar	4,892	7,258	9,794	14,697
Mainland cane.....	do.	9,541	14,556	25,842	61,147
Hawaii.....	do.	3/	2/	2/	2/
Puerto Rico.....	do.	6,356	5,133	6,997	9,472
Virgin Islands.....	do.	1,167	2,628	4,256	13,364
Share of receipts from Government:					
Beet.....	Percent	18.1	17.3	16.7	15.3
Mainland cane.....	do.	14.7	14.0	13.3	10.3
Hawaii.....	do.	3/	2/	2/	2/
Puerto Rico.....	do.	16.4	16.4	14.3	11.2
Virgin Islands.....	do.	17.1	15.8	17.3	11.3

1/ Crop year for harvested area, yield, and sugar produced; otherwise calendar years.

2/ From processors and Government payments.

3/ Data not available.

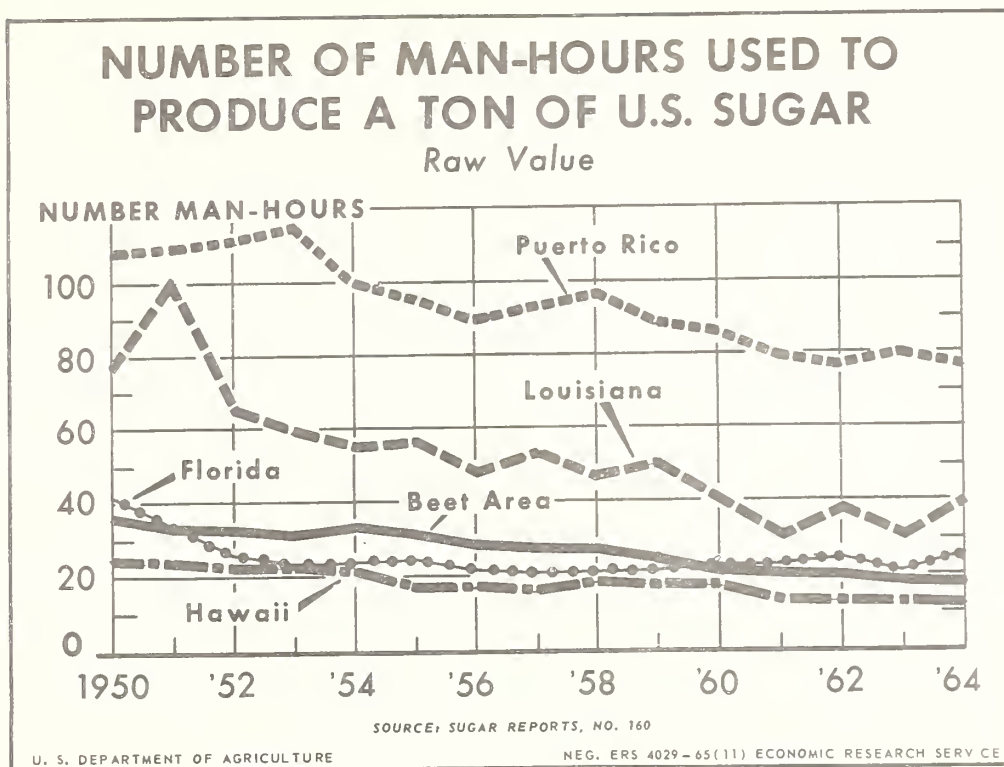


Figure 1

various net returns from the sale of sugar and for various percentages of sucrose in the beets.

The price provisions of grower-processor contracts are subject to bargaining between growers and processors. In most beet-growing areas, growers have formed associations to help them in such bargaining, and for other purposes.

The present form of grower-processor contracts in the beet industry was adopted in most areas shortly after World War I. Changes since then have been largely confined to matters of detail. The U.S. Sugar Act gives the Secretary of Agriculture authority to determine minimum prices which processors must pay for sugarbeets if they are to receive payments under the Sugar Act for any sugarbeets they may grow. However, processors produce only a negligible quantity of sugarbeets. The Secretary has never exercised this authority in connection with sugarbeets, although the contract terms are reviewed regularly by the Department of Agriculture.

Most sugarcane processors in domestic areas grow part of the cane they process and purchase the remainder from other growers. The proportion grown or purchased varies widely among processors. For the mainland area, Hawaii, Puerto Rico, and the Virgin Islands, the Secretary of Agriculture issues "Determinations" each year specifying the minimum price provisions. Ordinarily, separate determinations are issued for Louisiana, Florida, and each of the other domestic areas. Since only a small proportion of Hawaiian sugarcane is grown by independent operators, grower-processor contracts in that State are not as important as in other areas.

In domestic sugarcane areas, the grower-processor contracts are concerned almost exclusively with the price to be paid for cane. The determinations of minimum



prices set by the Secretary of Agriculture usually become the actual prices paid by the processors. These prices, except for Hawaii, are related to the prices quoted for raw sugar in New York for stated periods each year and to the quality of the sugarcane. The pricing period varies among areas and sometimes from year to year for the same area.

Sugarcane growers bargain with processors over the price they are to receive for their cane, although in most areas they do not appear to be as highly organized as are sugarbeet growers. They frequently make an attempt to persuade the Department of Agriculture to raise the minimum scale of payments set in the Secretary's determination.

For the most part, the present forms of payment for sugarcane have been evolved since the U.S. sugar quota system was established in 1934.

### Sugar Processors

Both sugarbeets and sugarcane require extensive processing in plants located relatively close to the area where the crop is grown, in contrast to cane sugar refiners which are located in large port cities. These sugarbeet and sugarcane plants are relatively large; each one, particularly of the newer plants, processes the crop grown on thousands of acres.

In 1963, there were 60 beet-sugar mills operating in the United States, owned by 11 corporations. The largest corporation, with 18 mills, produced about 26 percent of the U.S. beet sugar produced that year. The output of the six largest beet-processing companies amounted to 75 percent of that year's crop. The number and relative size of these corporations has not changed materially since World War II, except for the disappearance of two or three of the smallest companies and the addition of two new companies.

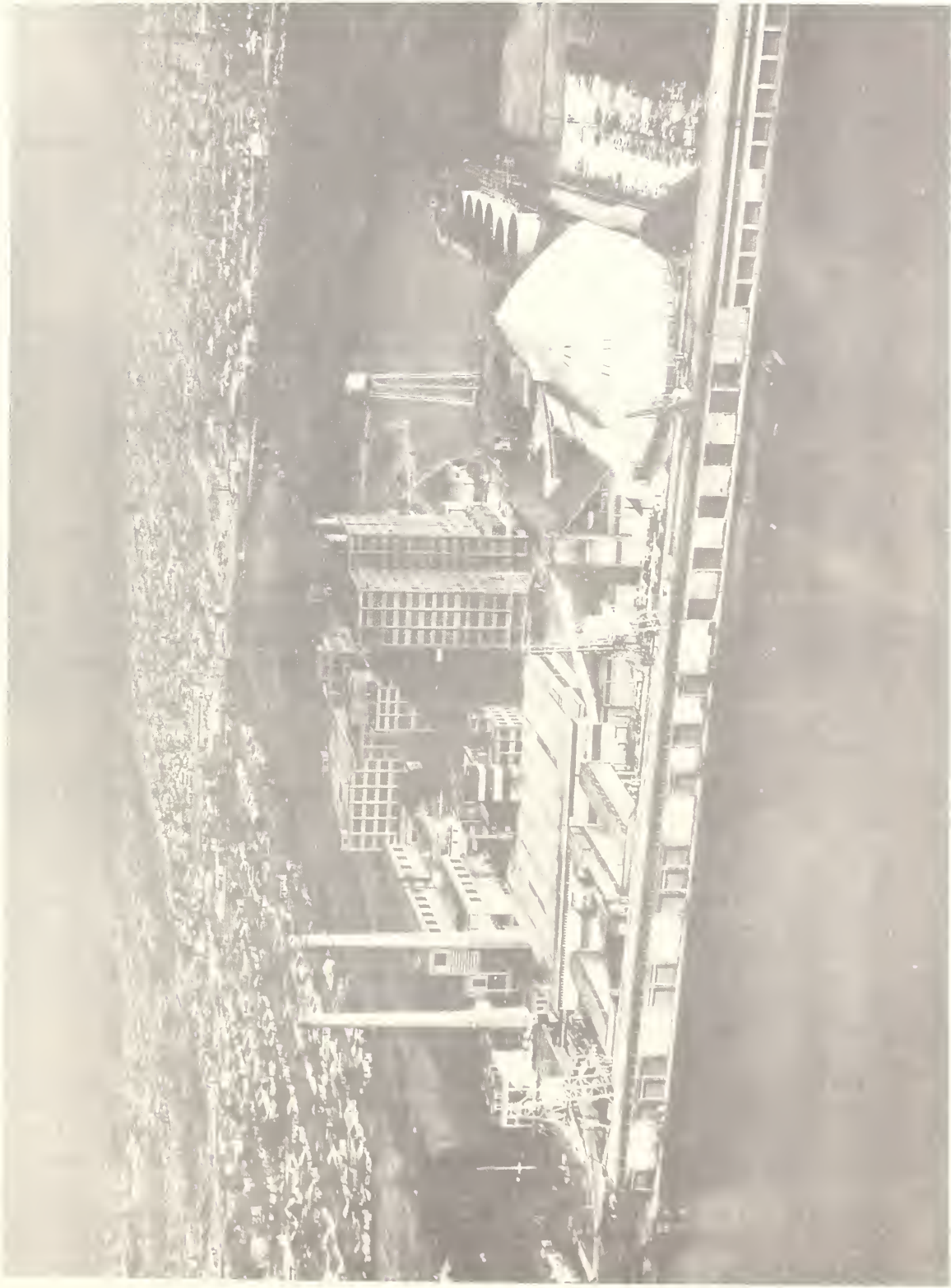
Beet-sugar processing plants are located in 14 States in the area where beets are grown. These plants are oriented toward the source of supply of their raw material--sugarbeets--rather than consuming centers as are cane-sugar refineries.

California produces more beet sugar than any other State, and Colorado is second. These two States produced 43.5 percent of the U.S. total output in the crop year 1963-64. Plants in seven States, all west of the Mississippi River, produced about 80 percent of the total.

Of the new beet-sugar mills built in recent years and scheduled to be built in the near future, two will be in the eastern part of the United States.

Contracts between sugarbeet processors and growers are commonly described as price participating. Although the details vary among companies, and sometimes regions served by a single company, all grower-processor contracts provide that the returns received by the corporation from the sale of sugar shall be divided between processors and growers according to a formula specified in the contract.

The contracts give the processors complete control of the marketing of sugar. However, both growers and processors have an interest in having the sugar sold for the highest net price (commonly called net returns) possible, although the interest of the two parties in this in most cases is not equal. Growers typically receive about 58 percent of the net income from sugar sales, but the payment scales are so



A large cane sugar refinery situated on the bank of the Mississippi River: The dome-shaped building in the foreground is a warehouse for raw sugar. (Courtesy of American Sugar Company.)



arranged that at present price levels about 75 percent of any change in sugar prices is reflected in returns to growers.

Except in 1963 and early 1964, U.S. sugar prices have been relatively stable and the probability of gain or loss from price change correspondingly small. U.S. production of beet sugar increased rapidly in 1962 and 1963 as changes in the Sugar Act permitted increased marketing. Reflecting these changes, six new mills have been or are being constructed, and the capacity of several old mills has been increased.

Sugarcane usually is first processed into raw sugar, which is later converted to refined sugar in separate refineries. In 1963, there were 26 mills grinding sugarcane and producing raw sugar in Hawaii, 45 in Louisiana, 9 in Florida, 27 in Puerto Rico, and 1 in the Virgin Islands.

The mills producing raw sugar in Hawaii are nearly all separate corporations which are owned or controlled by five larger corporations. Most of the sugarcane produced in Hawaii is grown by the companies owning the sugar mills. All Hawaiian sugar is marketed through a single cooperative corporation which owns and operates a large refinery in the San Francisco area where most of the raw sugar produced in Hawaii is refined and from which it is marketed. The cooperative also sells some raw sugar to other refineries, chiefly to a company with a plant in Texas in which it has a financial interest. As a result of these arrangements, the production and marketing of Hawaiian sugar is the most highly integrated of any in the United States.

All the raw sugar in Puerto Rico is produced by 19 companies. One of the largest of these companies is a subsidiary to one of the largest sugar-producing companies in Hawaii. Another mill is owned by a company which also owns and operates a raw sugar mill in the Dominican Republic and two mills in Florida. Most milling companies in Puerto Rico own extensive areas planted to sugarcane and thereby supply a large part of the cane they process for sugar. However, nearly all the milling companies purchase some sugarcane from independent growers.

Processing companies in Puerto Rico sell their raw sugar to refiners in the continental United States, except for small quantities refined in Puerto Rico. Most of it is shipped to plants located in port cities in the northeastern United States. Sales may be in shipload lots or may be made under contracts involving larger quantities. Independent sugarcane growers receive payment either in the form of raw sugar (an agreed percentage of the quantity recovered from their sugarcane), or in money, in which case the price is based on some average of price quotations for raw sugar over a stated period of time. Most payments are made in money rather than sugar. When payment is taken in sugar, the sugarcane grower commonly makes some arrangement whereby the processor sells his sugar for him.

Nearly all the raw sugar produced in Louisiana is refined in the New Orleans area. About one-fifth of the raw sugar is produced by three corporations which also operate refineries. The raw sugar produced by these firms is not sold in raw form but is refined in their own plants. Also, around 4 percent of the Louisiana production is produced in semirefined form, such as turbinado, 1/ and sold as direct-consumption 2/ sugar. The remaining part of the raw sugar produced in Louisiana is sold to refiners. In many cases, the entire output of a sugarcane processor is sold on an annual contract, the price being established in some specified relationship to the New York price of raw sugar during a specified period of time. This time period

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1/ A trade term for a type of partly refined cane sugar.

2/ Any sugar sold for use without further refining.

commonly is the same as that used in calculating the price to be paid growers for their sugarcane. Both the raw sugar and the sugarcane contracts provide for premiums or discounts in the price depending on the sucrose content of the cane or the polarization of the raw sugar. Sugarcane growers also receive a share of the returns from the sale of molasses by the processor when the price of molasses is above a stated minimum.

The system of marketing sugarcane and raw sugar in Florida is similar to that in Louisiana. However, until recent years only about 8 percent of the sugar produced in the State was refined by processing companies which also ground cane. This proportion has risen considerably since 1964 following the construction of new refining facilities in the State. Most raw sugar produced in Florida is sold to a refinery near Savannah.

The production of sugar in Florida, with the exception of one mill and plantation, is located on muckland in the Everglades south of Lake Okeechobee. The land south of Lake Okeechobee is protected by the lake from many of the frosts which sometimes occur elsewhere in southern Florida. The extent of this protection varies considerably within the cane-growing area, the greatest protection being in the area close to the south shore of the lake.

Sugar production in Florida has increased rapidly since 1960 when the stopping of imports from Cuba provided an opportunity for increased marketing of domestic sugar. Quotas under the U.S. Sugar Act were changed to permit such larger marketings from domestic areas.

There are 16 companies in the United States which refine raw cane sugar. Five of these also produce raw sugar from sugarcane grown in Louisiana or Florida and another is owned by a group of companies producing raw sugar in Hawaii.

The principal cane-sugar refineries in the United States are located in or near metropolitan areas: San Francisco, Houston, New Orleans, Savannah, Baltimore, Philadelphia, New York, and Boston. Inland refineries are in St. Louis and Chicago and two small refining plants have recently been built in southern Florida.

The size of plants refining cane sugar varies widely. In general, the plants operated by companies which also grind sugarcane are comparatively small. However, the plant in California owned by Hawaiian sugar interests is the largest cane-sugar refining plant in the United States. The refining plants in St. Louis and Chicago and one of those in New York produce liquid sugar only and are comparatively small. The plant in the New York area owned by a large producer of corn sweeteners sells sugar to industrial users only and does not deliver any of its product in packages smaller than 100 sacks. This plant produces both dry and liquid sugar, but it tends to specialize in liquid sugar and in blends of liquid sugar and corn sweeteners.

The remaining cane-sugar refiners appear to have no special connections with sugarcane growers or raw-sugar producers, with other segments of the sweetener industry, or with sugar users. The largest cane-sugar refining company, with five plants, might be regarded as an exception, since the company also owns one of the larger beet-sugar processing companies in the United States.

Statistics showing the output of the various cane-sugar refiners are not available.

Small quantities of raw cane sugar are refined in both Hawaii and Puerto Rico. Part of this sugar is used in those islands, and the rest is shipped to the mainland.

The amount of such shipments is limited by the size of the quota for refined sugar for these areas provided in the U.S. Sugar Act. The United States also permits the importing of small quantities of refined sugar from foreign countries. Such imports in 1963 amounted to about 2 percent of the sugar consumed.

While there have been numerous improvements in techniques used in processing sugarbeets and sugarcane and in refining raw cane sugar, the basic nature of the operations has not changed appreciably for several decades. Also, the useful life of processing plants, so long as suitable raw material in needed quantities can be obtained at competitive prices, is quite long, although maintenance costs increase somewhat with the life of a plant. Several plants more than 50 years old are still in operation.

Under these circumstances, most processing plants employ many long-established methods and have a relatively large proportion of jobs that require relatively simple skills and little training.

#### Distribution of Refined Sugar

Sugar intended for consumption without further refining is distributed to users by four classes of producers or dealers. In 1965, the quantities handled by each were:

	<u>1,000 tons</u>	<u>Percent</u>
Cane-sugar refiners . . . . .	6,335	67.3
Beet-sugar processors . . . . .	2,828	30.1
Importers of direct-consumption sugar . .	176	1.9
Mainland cane sugar mills . . . . .	<u>65</u>	<u>.7</u>
Total . . . . .	9,404	100.0

#### Forms in Which Distributed

Refined sugar is distributed to users as dry sugar in packages or in bulk, as a liquid in bulk, and as blends of sugar and corn sirup, or sugar and dextrose. Except for sugar in 100-pound sacks, nearly all packaged sugar is used in households and institutions such as restaurants. Since the end of World War II, there has been a rapid increase in bulk deliveries of sugar to industrial users, in both dry and liquid forms. The delivery of blends of liquid sugar and either corn sirup or dextrose also has increased. Likewise, the relatively small deliveries of sugar to institutions such as restaurants have risen.

The distribution of sugar to industrial and household users is a year-round business, although consumption is somewhat greater in the summer and fall than during the rest of the year. Production of beet sugar, however, is a highly seasonal operation, particularly in individual plants. Under these circumstances, sugarbeet processors need sizable inventories of sugar during their processing season in order to be able to supply their regular customers throughout the year. Unexpected shifts in the demand for sugar, particularly towards the end of any marketing year, sometimes cause some difficulty for beet-sugar processors; they either find themselves short of sugar to supply their customers or find it necessary to carry more sugar than planned into next year's marketing season.



The problem of providing year-round service to their customers is somewhat different for cane-sugar refiners. These plants operate throughout the year and can, within limits, adjust their output to current demand. They usually hold smaller stocks of refined sugar during most of the year than those maintained by beet-sugar processors, although they distribute more than twice as much sugar.

Refiners, however, must anticipate demand for refined sugar to schedule delivery of raw sugar, most of which arrives by ship. Although refiners usually hold somewhat larger stocks of raw than of refined sugar, buying raw sugar and arranging desirable delivery dates are important functions of managing a refinery.

Transportation costs are particularly important for beet sugar, because most of the factories where beet sugar is produced are distant from any large population center where the sugar could be consumed. While only about 20 percent of the beet sugar produced in the United States is produced east of the Mississippi River, 48 percent was delivered in this area.

The Hawaiian cane sugar refined in a California plant competes more directly with beet sugar than does sugar produced in eastern refineries. Although figures showing the geographic pattern of deliveries from the California plant which refined Hawaiian sugar are not available, trade reports indicate that they cover a much wider geographic area than deliveries from other cane-sugar refineries because of this competition. Refining plants on the Gulf and Atlantic coasts serve customers largely on the western fringe of their territories, rather than throughout the territory as is true of refining plants in California.

#### Effect of Basing-Point Prices on Distribution

The system of selling sugar is such that no definite, fixed geographic lines of demarcation for the marketing of refined sugar produced in various areas exists. Sugar is commonly sold on a basing-point price system. The quoted prices, or offers by sellers, do not necessarily represent the cost of the sugar delivered to the buyer. The delivered cost may be equal to, greater than, or less than the quotation.

Under the basing-point system, the sellers pay the cost of moving the sugar to the point of delivery, but they add a charge, called a prepay, to the price. This prepay is supposed to be equal to the lowest cost of shipping sugar from a point of origin to the particular destination. For example, the prepay charged by sellers on sugar shipped from Colorado to Chicago is set so as to make the cost to buyers in Chicago equal to that of sugar from other origins.

In the above example, the prepay for Colorado sugar ordinarily would be less than the transportation cost, and the sellers' net returns would be less than the quoted price. However, for nearby destinations, such as Denver, the prepay would exceed transportation charges, and the seller would realize what is termed a freight gain rather than a freight loss. In other instances, usually deliveries in the major port cities where cane-sugar refineries are located, no freight gain or loss ordinarily accrues to the seller.

Minor producing areas like those in Michigan and Ohio sell their beet sugar locally and are not involved in the calculation of prepay to areas such as Chicago.

In practice, basing-point prices frequently do not work out as neatly as has been described. Competitive conditions may cause one or another group of sellers to

offer various concessions which result in prices different, usually lower, than would otherwise be expected. Prices in Chicago are often cited as an example of this type of market. The probable cause is that the quantity of western beet sugar shipped there has increased faster than the quantity of cane sugar shipped from the South and East. Various price concessions, not available in most of the rest of the country, appear to have been an important factor in accomplishing this.

The total number of primary distributors or sellers of refined sugar is comparatively small. An even smaller number appear to do most of the business, although the available data are incomplete, especially for cane-sugar refiners. Because of the geographic pattern of sugar distribution in the United States, the concentration of volume in a few companies is much greater in certain areas than for the entire country. For instance, about 10 percent of the total quantity of refined sugar distributed to buyers in 1963 was delivered in California. Judging from the location of processing plants, three companies were in position to supply a major share of this. Deliveries in Illinois in 1963 were slightly larger than those in California--about 11.6 percent of the total--but the number of suppliers in geographic position to serve the market was considerably larger because of the central location of Illinois.

### Trends Since World War II

The relative quantities of sugar delivered in various States since the close of World War II have varied appreciably, largely because of shifts in population and increased industrial use, which also has been affected by population changes. The three States where the largest quantities of sugar are delivered by primary distributors are New York, Illinois, and California. The proportion of total U.S. deliveries made in these States has approximated 30 percent since 1948. However, the trends in deliveries going to each State have varied considerably from each other and from the U.S. average (table 3).

Deliveries in New York (nearly all cane sugar) increased only slightly during the 17-year period 1948-65 compared with an increase of about one-fourth for the United States and considerably larger increases in both Illinois and California.

On the other hand, deliveries of cane sugar in the southern States have increased substantially. In Georgia, such deliveries during 1960-65 were nearly one-third above those for 1948-52. However, the total quantity delivered in that State in 1965 was less than 300,000 tons, much smaller than deliveries in New York.

About three-fourths of the total increase in sugar deliveries in California from 1948-52 to 1960-64 was beet sugar, and the remainder cane. The increase in deliveries of beet sugar since 1956 has been more rapid than prior to that time. The increase in sugar deliveries in California has favored the increased beet sugar production in that State, since it has served to reduce the quantities of California beet sugar which otherwise would have had to be marketed in the midwestern and eastern parts of the country.

The increase in beet-sugar deliveries in Illinois from 1948-52 to 1958-64 amounted to about 81 percent of the combined increase in cane and beet sugar deliveries in that State during the period. As in California, the beet-sugar share has increased more rapidly since 1956 than before. Growth in population was a less important factor in the trend in Illinois than in California. Beet sugar accounted for about half the increase in sugar deliveries for the entire United States, and half of the increase in deliveries of beet sugar was in California and Illinois.



Table 3.--Trends in distribution of refined sugar by primary distributors in selected States, 1948-65

Year	New York		Illinois		California		United States	
	Quant-	Index	Quant-	Index	Quantity	Index	Quantity	Index
	tity	1948-52=	tity	1948-52=	1948-52=	1948-52=	1948-52=	1948-52=
	: 100	:	: 100	:	: 100	:	: 100	:
	: 1,000		1,000		1,000		1,000	
	: tons		tons		tons		tons	
1948.....	861	100.6	611	92.1	551	91.2	6,866	94.1
1949.....	835	97.5	666	100.4	557	92.1	7,584	97.1
1950.....	957	106.0	727	109.6	602	99.6	7,727	105.9
1951.....	828	96.7	639	96.3	649	107.3	7,232	99.2
1952.....	850	99.3	674	101.6	664	109.8	7,558	103.6
1953.....	935	109.2	765	115.4	730	120.6	7,913	108.5
1954.....	888	103.7	647	97.6	698	115.3	7,668	105.1
1955.....	887	103.6	730	110.0	732	121.1	7,917	108.5
1956.....	879	102.6	809	122.0	818	135.3	8,375	114.8
1957.....	874	102.1	814	122.7	806	133.3	8,203	112.5
1958.....	852	99.5	838	126.3	804	132.9	8,480	116.3
1959.....	856	100.0	875	130.5	865	143.0	8,612	118.2
1960.....	871	101.7	847	127.6	821	135.8	8,695	119.2
1961.....	897	104.8	931	140.3	887	146.6	9,025	123.7
1962.....	912	106.5	977	147.3	916	151.4	9,134	125.2
1963.....	896	104.6	1,086	163.7	946	156.5	9,373	128.5
1964.....	862	99.5	963	145.2	963	159.2	9,073	122.7
1965.....	823	95.0	1,087	164.0	995	164.5	9,405	127.2

The year 1956 is significant in the trends of beet-sugar deliveries because of a revision of the sugar quota law that year, which provided increased quotas for beet sugar.

#### CORN SWEETENERS

Corn sirup and dextrose are produced in the United States by the corn wet milling industry. They are produced from cornstarch, with the exception that one plant in Texas uses starch from grain sorghum. These sweeteners are manufactured by about 9 companies in the United States in some 12 plants, all located in midwestern States, except for the one in Texas. The corn or grain sorghum used is commonly purchased in the market as needed.

The quantities of corn and grain sorghum used for this purpose represent only very small proportions of the total quantities produced in the United States--only about 5 percent for corn. Moreover, a considerable proportion of the starch in corn purchased by the corn wet milling industry is not used for the production of corn sirup or dextrose, but is sold as starch.

The price of corn is a more important factor in determining the profits of the corn wet milling industry than are the prices of beets or cane for the sugar industry. The industry's purchases of corn are small in relation to the size of the crop and have little effect on the price of corn. On the other hand, the corn sirup and dextrose produced by the industry are sold in competition with sugar and other sweeteners, the prices of which are not directly related to the price of corn.

This lack of direct cause and effect relationship between the cost of the raw material and the market price of the product is in marked contrast to the situation in the sugar industry, where sugarbeets and sugarcane have little economic value except for the production of sugar, and the prices paid for beets and cane are directly related to sugar prices.

The quantity of corn sirup sold in the United States more than doubled during 1948-64 compared with a 32-percent increase for sugar, and 42-percent for dextrose.

The increase in sales of corn sweeteners has been especially rapid since 1961. In the 3 years 1961-64, sales of corn sirup increased 32 percent and of dextrose 22 percent as compared with a 3.4 percent increase in sales of sugar.

The comparatively rapid increase in the use of corn sweeteners in recent years appears to have been mainly at the expense of sugar, although some increase doubtless has occurred in processes for which sugar would not have been used in any case. Factors responsible for the rapid increase in the use of corn sweeteners include:

1. A widening price differential between corn sweeteners and higher priced sugar, particularly after 1955 (fig. 2). This is discussed in the section on sweetener prices.

2. Improvements in corn sweeteners, particularly corn sirup, which have enabled suppliers to offer their customers a greater variety of sirups and thus fill their needs more exactly. Examples of this are sirups with a high content of maltose and those containing about 95 percent dextrose. Both have been introduced since 1960.

3. The sale of increasing amounts of corn sweeteners in mixtures with liquid sugar, enabling buyers to use blends of sweeteners without the necessity of preparing them themselves. The quantity of corn sirup sold in mixtures by sirup producers, cane-sugar refiners, beet-sugar processors, or independent sirup mixers amounts to about 16 percent of total corn-sweetener sales in the United States. In addition, many users prepare their own blends. No figures showing the quantity of corn sirup blended with liquid sugar by users are available.

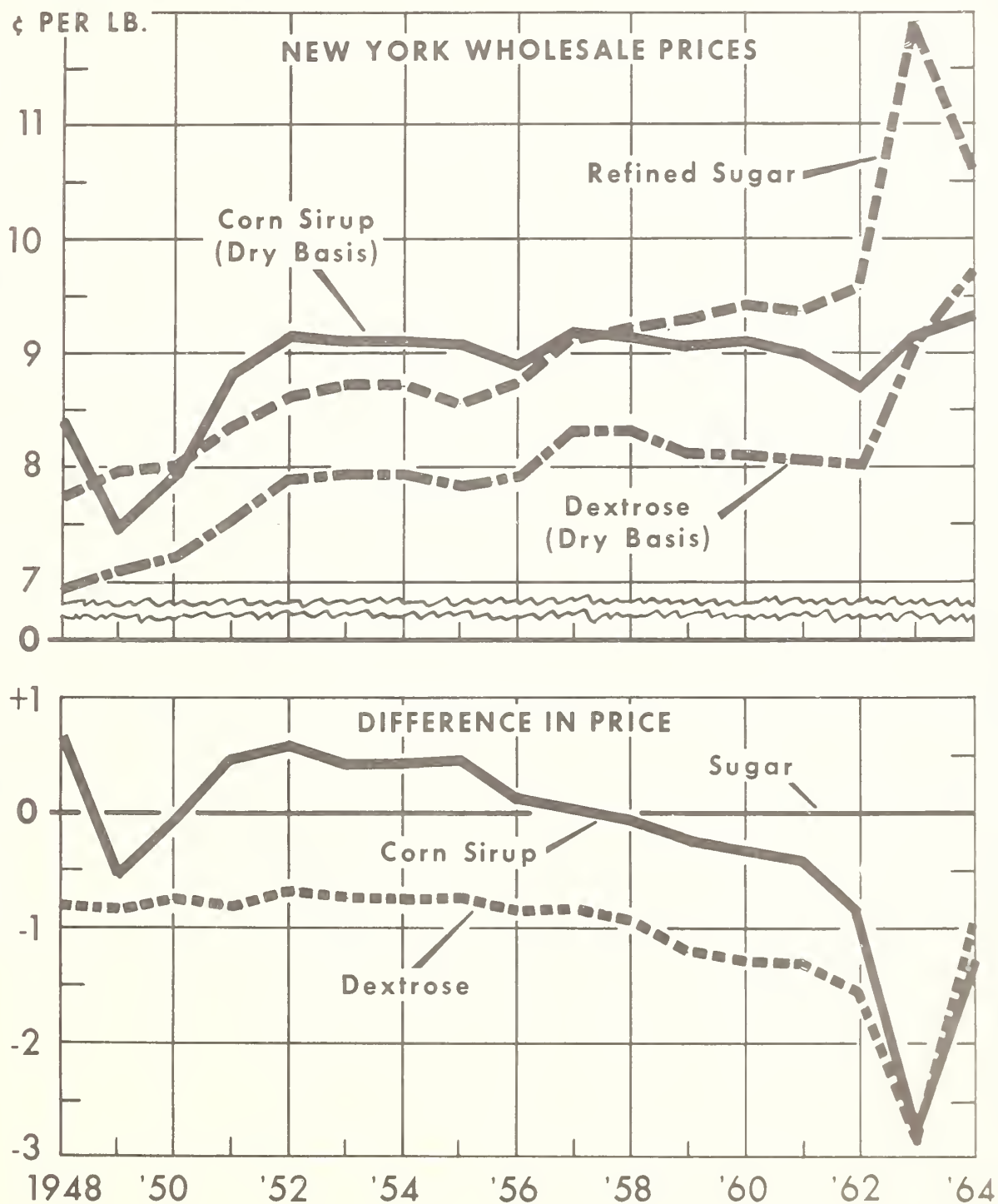
Corn-sweetener producers have actively promoted their product and showed users the advantages they could obtain with it. Results have been slow, but in many cases, cumulative.

## NONCALORIC SWEETENERS

The oldest of the noncaloric sweeteners is saccharin. Until recently, there were only two producers of saccharin in the United States. By the end of 1965, there were four producers. Until recent years, the use of sacchrin appears to have been limited largely to products consumed by persons who, for health reasons, were unable to use foods sweetened with sugar. Products sweetened entirely with saccharin sometimes have an undesirable aftertaste which makes them objectionable to some people. This appears to be a limiting factor in the use of saccharin.

Sodium cyclamate and calcium cyclamate were first marketed as sweetening agents in the early fifties. Since that time their use, especially the use of calcium cyclamate, has grown comparatively rapidly, particularly in the production of soft drinks. In recent years, mixtures of the cyclamates and saccharin have been marketed. For some uses, these appear to be superior to either used alone.

# REFINED SUGAR DEXTROSE AND CORN SIRUP; NEW YORK WHOLESALE PRICES, AND DIFFERENCES IN PRICE



U. S. DEPARTMENT OF AGRICULTURE

ERS NEG. 4030 - 65 (11) ECONOMIC RESEARCH SERVICE

Figure 2

The production of cyclamates probably has increased more rapidly than that of any other sweetener since 1962. Available data are limited, but trade reports indicate that production capacity by December 1965 was about 30 million pounds annually, 4 to 5 times the 1962 capacity.

Imports of saccharin, again mostly from Japan, amounted to about 785,000 pounds in 1964, considerably less than in 1963. Imports may decline further because of lower prices and increased domestic production capacity.

Trade estimates show that about half of the noncaloric sweeteners sold in the United States are used in soft drinks; about 7 percent of the total output in 1963 was manufactured with noncaloric sweeteners. This is five times the 1959 output.

### TRENDS IN THE USE OF SWEETENERS

Industrial food processors are the largest users of sweeteners in the United States. Even for sugar, where household use has always been a major market outlet, the proportion being delivered directly to industrial food processors has been increasing, at least since 1929, the earliest date for which records are available. In 1929, about 28 percent of the sugar used in the United States was delivered directly to food processors; in 1965 it was 60 percent (table 4). These figures cover only direct deliveries by primary distributors to industrial users. In addition, some industrial users received some sugar through wholesalers but the quantity involved is unknown.

Deliveries of sugar to household users have remained approximately constant in volume since the end of World War II, but amounted to only about 29 percent of total sugar deliveries in 1965, compared with 38 percent in 1949. Sugar for household use is distributed in a variety of packages, usually containing 10 pounds or less per package. It includes various specialty types such as brown sugar, powdered or confectionery sugar, and cubes.

The preparation and packaging of sugar for the retail trade involves additional expense, and prices are somewhat higher than those charged for delivery to industrial users. Cane-sugar refiners as a group specialize to a greater extent than beet-sugar processors in the distribution of sugar in consumer packages. In 1965, only about 19 percent of the beet sugar used in the United States was distributed in consumer packages, as compared with 34 percent for cane-sugar refiners. However, there are wide variations within each group. Some cane-sugar refiners deliver no sugar in consumer packages, while trade reports indicate that such business amounts to as much as half the volume of others. Also, beet-sugar processors in Michigan and Ohio deliver a much larger proportion of their sugar in consumer packages than most other beet processors.

The variations among cane-sugar refiners represent specialization within the industry and probably result in more efficient use of the specialized equipment needed to prepare and market sugar in a wide variety of packages of small size. The emphasis on consumer packages by beet-sugar processors in Michigan and Ohio is influenced by their geographic location. They are closer to large centers of population than other beet processors, therefore are able to market their entire output of sugar in an area close to their plants. Even so, they distribute a smaller range of types of sugar and packages than do cane-sugar refiners.







Among industrial groups of sugar users, the beverage industry is the largest, and its share of the total has been increasing since 1949. The largest share of the sugar delivered to the beverage industry is used in soft drinks. There is no evidence that soft-drink producers have increased the amount of sweetener used per unit of output. Consequently, the increase in sweetener use appears to be the result of the increasing output of soft drinks.

Nearly all the corn sirup and dextrose sold in the United States is delivered to industrial users, mostly food processors. The confectionery industry is the largest user of corn sirup, although the increase in deliveries to the industry have been much slower than the increase for other uses. This is largely a result of the relatively slow growth in the output of hard candies, the type for which corn sirup is most important.

The total distribution of dextrose for all purposes was about one-third greater in 1965 than the 1949-53 average. The most significant shift among classes of users has been the threefold increase in deliveries of dextrose to nonfood industrial users. Trade reports indicate that increases in the nonfood uses of dextrose are likely to continue. These uses appear to be largely in the chemical industry. In many of these uses, dextrose as a raw material competes with sugar (sucrose), and in recent years the price advantage of using dextrose rather than sucrose has been increasing.

Data showing the quantities of noncaloric sweeteners distributed to different types of users, similar to figures for caloric sweeteners, are not available. However, the largest use, at least for the cyclamates, is in the production of soft drinks. They are also used in many other food products, and in pharmaceuticals. Retail sales have been increasing in importance, so that these products compete with sugar in both the industrial and the retail markets.

There has been considerable discussion by people in the sweetener and soft-drink industries concerning the extent to which the increasing use of noncaloric sweeteners in soft drinks has increased the size of the market for these products or merely replaced sugar. Little direct evidence is available, but an industry survey indicated that about 52 percent of the purchasers of soft drinks at supermarkets in the United States in early 1964 were buying low-calorie beverages and 41 percent of these reported buying them instead of those sweetened with sugar. 3/

## SWEETENER PRICES

### Sugar

From the end of World War II through 1962, the price of sugar in the United States rose slowly, but was unusually free of large fluctuations. This was in sharp contrast to the "world" price, which was much more variable (table 5). 4/

The average year-to-year change in the New York price of raw sugar from 1948 through 1962 amounted to only 0.12 cent per year as compared with 0.61 cent for "world" sugar. The 1948-52 average price of raw sugar at New York was 5.95 cents per pound. It rose to 6.31 cents for the 1958-62 period. In contrast, the "world" price declined from a 1948-52 average of 4.64 cents per pound to 3.10 cents for 1958-62. It rose to a high level in 1963 but in 1965 was the lowest of any year since 1948.

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3/ National Bottlers' Gazette, April 1964.

4/ In this report, "world" sugar means only sugar shipped to nonpreferential destinations. This term is described in detail below.

Table 5.--Raw Sugar prices in cents per pound: U.S. and "world" markets 1948-65

Year	New York, duty paid	"World" sugar	Quota premium or discount <u>1/</u>
	-Cents-		
1948.....	5.54	4.23	+0.41
1949.....	5.81	4.16	+0.78
1950.....	5.93	4.98	+0.11
1951.....	6.06	5.67	-0.60
1952.....	6.26	4.17	+1.18
1953.....	6.29	3.41	+2.02
1954.....	6.09	3.26	+1.95
1955.....	5.95	3.24	+1.76
1956.....	6.09	3.48	+1.62
1957.....	6.24	5.16	+0.14
1958.....	6.27	3.50	+1.91
1959.....	6.24	2.97	+2.38
1960.....	6.30	3.14	+2.21
1961.....	6.30	2.91	+2.45
1962.....	6.45	2.98	+2.58
1963.....	8.18	8.50	-1.23
1964.....	6.90	5.87	+0.11
1965.....	6.75	2.12	+3.68

1/ Difference after adjusting the New York or "world" price for transportation costs and tariff. "World" price is the nonpreferential export price at port of embarkation of the exporting country.

#### Effect of Administrative Control on Prices

The differences in price behavior for "world" and domestic sugar are largely the result of the manner in which the U.S. Sugar Act has been administered, although the regulations and administrative actions of certain other sugar-importing countries such as the United Kingdom, Japan, and West Germany also have had some effect on "world" prices.

International trade in sugar in recent years has averaged about one-third of world production. The United States is by far the largest importer of sugar in the world, taking in recent years between 20 and 25 percent of the world's total imports. The next largest importer in most years is the United Kingdom, which takes from 12 to 15 percent of world imports. Because of unusually large purchases of Cuban sugar, imports by the U.S.S.R. in 1961 and 1962 exceeded those of the United Kingdom.

All sugar imported by the United States, until recently, has been on a preferential basis--that is, the exporters were granted certain quota and price advantages for sugar sold here as compared with sales made to other countries. The establishment in 1962 of a global quota by the United States and imposition of import fees designed to equalize or partly equalize price differentials between the United States and the "world" market changed this situation somewhat. However, the pre-1962 situation was restored by a 1965 amendment to the Sugar Act.

It is also true that most sugar imported into the United Kingdom receives some preference, either as a result of prices established under the Commonwealth Sugar Agreement or in the form of a preferential tariff rate. Certain other importing countries also make use of preferential treatment in their sugar trade.

However, some sugar entering international trade does so without benefit of any preference by an importing country. It is not possible to determine the exact amount of this trade. Preferences are of many kinds and degrees and are subject to more or less continuous change by the various importing countries. In recent years, it is doubtful if as much as half the world's imports of sugar could be classed as substantially nonpreferential. This would be only about 16 percent of world sugar production. The "world" prices usually quoted in the United States are those prevailing in ports in the "greater Caribbean area, including Brazil". These ports are the principal embarkation points for such sugar.

Not only the United States, but nearly all other importing countries have attempted to maintain relatively stable sugar prices in their domestic markets. An important way of doing this has been to vary the volume of sugar imports to offset the effect of circumstances that might cause sugar prices to fluctuate more than desired by importing countries. The United States has done this. One result of these actions by importing countries has been occasional sharp changes in the quantity of sugar they wished to import. Since only what would otherwise be nonpreferential imports ordinarily are available to meet these shifting demands, the "world" price of sugar has shown sharp fluctuations as importing countries have varied their volume of imports.

Frequently, these shifts in demand for imports occur more or less simultaneously in most or all importing countries. Sharp increases in demand occurred in all countries during the Korean and Suez crises and in 1963. "World" prices rose rapidly in each case.

#### U.S. AND "WORLD" PRICES

Except for one month in 1948, a period during the Korean crisis extending from approximately August 1950 through December 1951, and the Suez crisis during the first half of 1957, the prices of raw sugar in the United States from 1948 through 1962 were continuously above the equivalent level (adjusted for transportation costs and tariff) of prices in the "world" market. The difference averaged only 0.38 cent per pound during 1948-52; during 1958-62 it was 2.31 cents.

Early in 1963 it became apparent that unusual price rises were developing in both the United States and "world" markets. The "world" price of raw sugar, which averaged 2.98 cents per pound in 1962, rose to 10.36 cents in May 1963 and to 11.63 cents in November of that year. It declined to 2.76 cents in December 1964 and to 1.79 cents in August 1965 (table 6).

Price movements for raw sugar at New York were similar to, but less violent than, those in the "world" market. From an average of 6.45 cents per pound in 1962, the price of raw sugar at New York rose to 11.08 cents in May 1963. It reached another, but lower, peak of 9.42 cents in October 1963 and declined to 6.17 cents--below its 1962 average--in November 1964.

High sugar prices in 1963 were the result of a decline in world production in 1961-62 and again in 1962-63 from the all-time peak of 60,050,000 tons reached in 1960-61 (table 7). World production turned upward again in 1963-64 and in 1964-65 a new record was set about 9 percent above 1960-61.

The decline in world output was the result of two successive poor crops of sugarbeets in western Europe and a sharp drop in production in Cuba. Production in these two areas in 1961-62 was 4,326,000 tons below 1960-61. Output in the rest

Table 6.--Monthly raw sugar prices in cents per pound: United States and "world" markets 1963-65 <sup>1/</sup>

Month	1963			1964			1965		
	New York, duty paid	"World" sugar	Quota premium or discount <sup>2/</sup>	New York, duty paid	"World" sugar	Quota premium or discount <sup>2/</sup>	New York, duty paid	"World" sugar	Quota premium or discount <sup>2/</sup>
						Cents			
January.....	6.70	5.41	+0.40	9.29	10.64	-2.28	6.85	2.41	+3.52
February.....	6.80	6.05	-0.15	8.02	9.11	-2.02	6.79	2.25	+3.61
March.....	7.04	6.62	-0.47	7.33	7.43	-1.03	6.61	2.63	+3.04
April.....	8.26	7.65	-0.28	7.43	8.05	-1.54	6.59	2.40	+3.25
May.....	11.08	10.36	-0.19	6.65	7.12	-1.39	6.73	2.35	+3.42
June.....	8.70	9.92	-2.12	6.45	5.33	+0.20	6.72	1.96	+3.80
July.....	7.95	9.05	-2.00	6.25	4.80	+0.53	6.73	1.94	+3.83
August.....	6.65	6.63	-0.88	6.18	4.37	+0.89	6.77	1.79	+4.02
September.....	7.45	7.63	-1.09	6.20	3.71	+1.57	6.82	1.85	+4.01
October.....	9.42	10.67	-2.18	6.27	3.70	+1.65	6.82	2.03	+3.83
November.....	9.34	11.63	-3.23	6.17	3.40	+1.85	6.80	1.81	+4.03
December.....	8.78	10.36	-2.52	6.55	2.76	+2.87	6.75	1.96	+3.83

<sup>1/</sup> "World" price is the nonpreferential export price at port of embarkation of the exporting country.  
<sup>2/</sup> Difference after adjusting the New York or "world" price for transportation costs and tariff.



Table 7.--World production of sugar, raw value, short tons, crop years  
1960-61 through 1964-65

Area	1960-61	1961-62	1962-63	1963-64	1964-65
- - - - -1,000 tons- - - - -					
United States.....	5,299	5,402	5,572	6,500	6,766
Cuba.....	7,459	5,308	4,211	4,000	4,500
Other North America.....	4,522	4,520	4,843	5,201	5,676
South America.....	6,894	6,925	6,828	7,106	7,657
Western Europe.....	10,607	8,432	7,797	9,036	9,740
Eastern Europe.....	5,073	5,228	4,626	5,014	5,353
U.S.S.R. ....	6,600	7,170	6,600	6,500	9,000
Africa.....	2,520	3,185	3,340	3,853	3,889
Asia.....	9,497	9,168	8,803	10,025	10,765
Oceania.....	1,669	1,695	2,273	2,256	2,347
World.....	60,060	57,093	54,893	59,491	65,693

of the world in 1961-62 was 1,369,000 tons above 1960-61. Production in western Europe recovered substantially in 1963-64 but not in Cuba. However, production in the rest of the world in 1963-64 was 4,471,000 tons above 1960-61.

World sugar production from 1948-49 through 1964-65 increased at an average rate of about 2,100,000 tons per year (fig. 3). Production in 1964-65 was not only the largest on record, it was about 1 million tons above what would have been expected on the basis of the trend from 1948-49 through 1963-64.

High sugar prices in the United States in 1963 and early 1964 were not the result of a shortage of supplies in this country; rather, they reflected world sugar conditions. Normally, sugar prices in the United States are insulated from price fluctuations in the "world" market. In 1963, however, the world shortage of sugar was serious enough to produce the highest prices in the "world" market since the initiation of the U.S. sugar quota system in 1934. The price in the "world" market was continuously above the equivalent level (adjusted for transportation costs and tariff) in the United States from February 1963 through May 1964. The difference reached a peak of 3.23 cents per pound in November 1963.

During this period, U.S. importers had to buy raw sugar in competition with traders purchasing "world" sugar for other markets. They were able to make such purchases at prices below those which the sellers could have obtained from other countries. This was possible because of the desire of producers in foreign countries to fill their quota and other commitments to the United States and thus protect their position in the U.S. market in future years. These desires, however, were not strong enough to induce sellers in foreign countries to accept prices as low as those of 1962. Consequently, prices in the United States rose but not as much as in the "world" market.

These price increases in the United States came at a time when the supply of sugar in this country, and commitments of producers in foreign countries to ship sugar here, were unusually large.



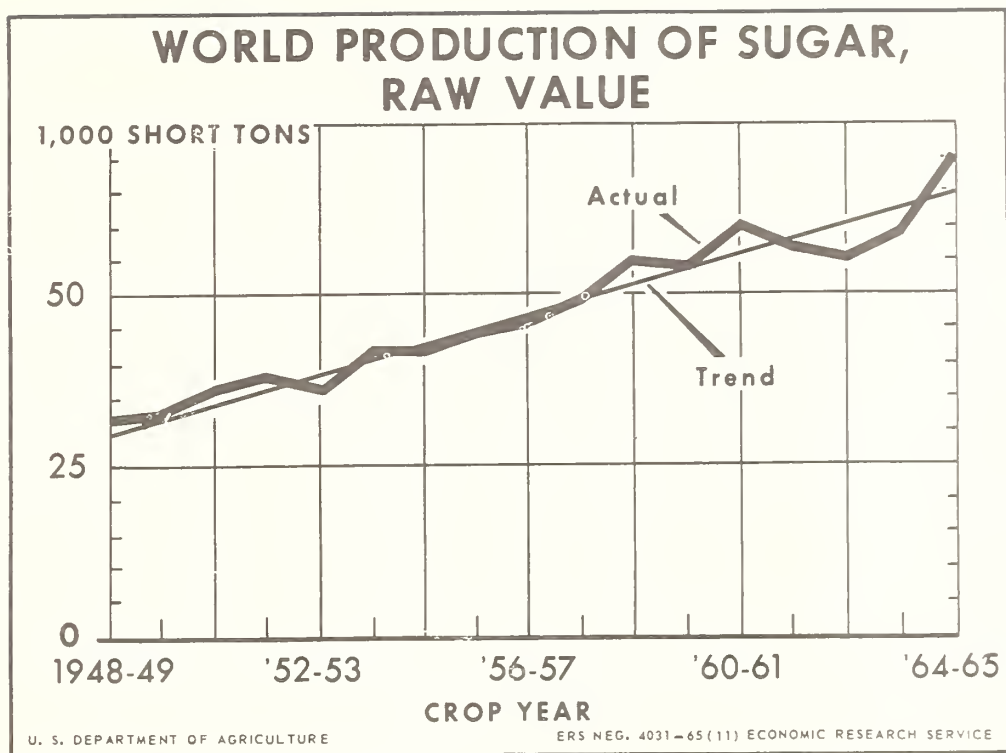


Figure 3

### Geographic Pattern of Prices

The increasing quantities of beet sugar marketed in the United States, both in tonnage and in relation to total sugar marketings, has been a major factor causing a shift in the relationships of sugar prices in various sections of the country. These shifts were fairly gradual from 1949 through 1962. They were much more pronounced after 1962.

Deliveries of beet sugar in the United States by primary distributors increased 62 percent between 1949 and 1962. The increase for cane sugar was 21 percent. In 1965, beet-sugar deliveries were 25 percent above those for 1962, while deliveries of cane sugar declined 4 percent.

As noted earlier, the pressure toward higher sugar prices in the United States came from the higher prices importers had to pay for imported raw sugar. Most of the sugar imported into the United States is refined in the northeastern part of the country in plants located in Baltimore, Philadelphia, New York, and Boston. As the cost of raw sugar purchased by refiners rose, they found it necessary to increase the price of the refined sugar they sold.

Western beet-sugar producers were able to increase their marketings substantially. Beet-sugar prices also rose but not as much as prices of cane sugar in the Northeast. Also, deliveries of beet sugar to customers in the northeastern States increased sharply--from 14,950 tons of refined sugar in 1962 to 128,000 tons in 1963 and 70,000 tons in 1964. The 1963 deliveries to these States amounted to less than 5 percent of the total deliveries of beet sugar that year.

As a result of these unusual circumstances, the geographic pattern of refined sugar prices in the United States in 1963, 1964, and 1965 differed appreciably from that of earlier years. In 1949-62, the quoted wholesale price of refined cane sugar in New York rose gradually from 7.97 cents to 9.60 cents per pound. It averaged 11.94 cents per pound in 1963 and 10.68 in 1964 (table 8). The quotations for beet sugar in the Chicago area, although somewhat below those in New York also increased during this period, but at a slower rate than in New York. As a result, the difference in quoted prices increased slowly from 0.11 cent per pound in 1949 to a peak of 0.81 cent in 1962. Since 1962, differences have been much larger.

It should be noted that these quotations represent basing-point prices and may differ appreciably from the cost of sugar delivered to users. The most significant thing shown in table 8 is the change in the differential between the various price series.

### Growers' Returns and Sugar Prices

Growers of sugarcane and sugarbeets receive payments for their beets or cane which are related, by determinations made by the Secretary of Agriculture, to certain features of the price of sugar in the United States. These Determinations also provide for variations in the price per ton of beets or cane according to the sucrose content and, in some cases, the purity, of the product delivered to the processor.

Table 8.--Comparative trends in the quoted wholesale prices of refined sugar in various areas of the United States, 1949-1965 1/

Year	: New York	Difference from New York price 2/							
	: price of	Cane sugar					Beet sugar		
	: refined	: Pacific	:	:	:	: Pacific	:	:	
	: cane	: Chicago	: Coast	: Gulf	: Southeast	: Chicago	: Coast	: Eastern	
	: sugar	:	:	:	:	:	:	:	
		<u>Cents</u>							
1949..	7.97	+.04	+.06	+.04	0	-.11	-.04	-.16	
1950..	8.00	0	+.09	0	0	-.20	-.01	-.18	
1951..	8.38	0	+.07	0	-.01	-.26	-.01	-.20	
1952..	8.62	-.01	+.05	-.07	-.02	-.21	-.06	-.20	
1953..	8.72	-.12	-.02	-.12	-.04	-.30	-.12	-.16	
1954..	8.72	-.16	-.22	-.17	-.13	-.37	-.32	-.22	
1955..	8.59	-.10	-.06	-.09	-.11	-.30	-.16	-.20	
1956..	8.77	-.19	-.02	-.17	-.13	-.39	-.12	-.25	
1957..	9.15	-.33	-.03	-.20	-.15	-.53	-.13	-.52	
1958..	9.27	-.38	-.06	-.31	-.14	-.59	-.14	-.66	
1959..	9.33	-.45	-.23	-.05	-.14	-.66	-.23	-.62	
1960..	9.43	-.46	-.47	-.04	-.03	-.66	-.47	-.64	
1961..	9.40	-.64	-.56	-.17	-.15	-.81	-.56	-1.04	
1962..	9.60	-.45	-.53	-.57	-.43	-.65	-.53	-.53	
1963..	11.94	-1.04	-1.23	-.64	-.49	-1.60	-1.23	-1.36	
1964..	10.68	-1.10	-.83	-.86	-.78	-1.30	-.83	-1.30	
1965..	10.22	-.87	-.98	-.78	-.69	-1.07	-.98	-1.07	

1/ Approximate boundaries for these areas are shown in "Sugar Reports," No. 81, p.6. U.S. Dept. Agr., Agr. Commod. Stabilization Serv., Jan. 1959.

2/ Cents per pound.

The terms of grower-processor contracts for beets vary somewhat among processors and geographic areas. In general, however, the price per ton of beets of a given sucrose content is determined from a table showing the price to be paid for beets for various net returns (price minus marketing costs) per pound realized by the processor from the sale of sugar. Prices also vary according to the sucrose content of beets. The higher the price or returns received for sugar the higher the payment per ton of beets of the same sucrose content, but the proportionate increase in the price paid for beets is usually greater than that for sugar.

The average price per ton received by growers from processors (not including Government payments) in the crop year 1948 (October 1948 through September 1949) was \$10.38. In 1964 it was \$11.75 (table 9). The average net price or return received by beet processors for their sugar increased from 6.61 cents per pound in 1948 to 7.50 cents in 1964.

Processor payments per ton of beets in 1964 were 4.5 percent above the 1948-52 average, while the net receipts per pound of sugar sold by processors was 7 percent above the 1948-52 average. Part, at least, of this difference is caused by the low average sucrose content of 1964 crop year sugarbeets.

The larger increase in processor payments per ton for sugarcane in the mainland area (Louisiana and Florida) than for sugarbeets, particularly since 1956 has been largely due to increases in the average sucrose content of sugarcane as compared with generally lower sucrose yields in sugarbeets. One reason has been the increasing proportion of the mainland sugarcane crop which has been grown in Florida, where the average sucrose content is regularly higher than in Louisiana.

Processor payments per ton of sugarcane in Puerto Rico were higher than those in the mainland cane area in most years. This is largely the result of the larger quantity of sugar recoverable from a ton of Puerto Rican sugarcane than from cane produced in the mainland area. During 1948-64, the average yield of sugar, raw value, per ton of sugarcane in Puerto Rico was 221 pounds, compared with 173 pounds on the mainland. However, during this period, sugar recoveries tended to decline in Puerto Rico and to increase in the mainland area.

Because of this decline, processor payments per ton of sugarcane in 1961, 1962, and 1963 were lower in Puerto Rico than in the mainland area. This occurred in spite of the fact that the reduced yields of sugar in Puerto Rico were still somewhat higher than those in the mainland area. The costs of moving raw sugar from Puerto Rico to mainland refineries are higher than the comparable costs for the mainland area. These costs are paid by the processors and have the effect of reducing processor payments for sugarcane in Puerto Rico below what might be expected for cane of similar quality in the mainland area.

The Hawaiian sugar industry is highly integrated, from cane growing through the sale of refined sugar. Most of the sugarcane is grown by processors who are primarily interested in the price of sugar rather than sugarcane.

The wholesale price of refined sugar in New York has increased somewhat more than that of raw sugar since 1948. In 1965, the wholesale price of refined sugar at New York was 3.47 cents per pound above the average raw-sugar price as compared with 2.15 cents in 1948. The spread in 1965 amounted to about 50 percent of the raw-sugar price. In 1948 it was 37 percent. In spite of this widening spread, one refinery in New York ceased operations in June 1964, reportedly because of financial losses.

Changes in the average price of refined sugar at retail for the entire United States have been at about the same rate as those for the wholesale price of refined sugar in New York, although the percentage rise in 1962 and 1963 was somewhat less for sugar at retail.

Table 9.--Prices for sugarbeets, sugarcane, and sugar in the United States, 1948-64

Crop year (Oct.-Sept.)	Processor payments per ton 1/			Price per pound						Basis of payment for beets
	Beets	Mainland cane	Puerto Rico cane	Raw sugar in New York 2/	Refined		Refined sugar, :		average U.S. :	
					Dollars	Dollars	Cents	Cents		
Dollars	Dollars	Dollars	Dollars	Cents	Cents	Cents	Cents		Cents	
1948.....	10.38	5.76	7.71	5.75	7.90		9.4		6.61	
1949.....	10.87	6.25	7.78	5.84	7.96		9.6		6.69	
1950.....	11.22	7.80	8.17	6.14	8.38		10.1		6.96	
1951.....	11.67	6.37	8.39	6.15	8.49		10.2		7.27	
1952.....	12.05	6.95	7.66	6.33	8.74		10.5		7.45	
1953.....	11.52	7.25	8.38	6.13	8.74		10.5		7.13	
1954.....	10.81	6.96	7.64	5.97	8.60		10.4		6.99	
1955.....	11.14	6.50	8.07	5.99	8.69		10.5		7.24	
1956.....	11.93	8.03	7.87	6.28	9.10		10.8		7.32	
1957.....	11.26	6.90	8.17	6.21	9.22		11.2		7.32	
1958.....	11.72	7.48	7.40	6.24	9.29		11.4		7.42	
1959.....	11.22	7.13	7.75	6.27	9.41		11.6		7.38	
1960.....	11.60	7.41	7.44	6.22	9.49		11.8		7.21	
1961.....	11.17	7.71	7.55	6.40	9.48		11.7		7.42	
1962.....	12.84	8.40	7.86	7.53	11.14		13.0		7.93	
1963.....	12.10	10.21	9.43	8.18	11.94		14.1		8.15	
1964 6/.....	11.75	6.90	8.15	6.90	10.68		11.8		7.50	

1/ Exclusive of Government payments.

2/ Duty paid.

3/ Including excise tax.

4/ Average price in 5 pound sacks in retail stores.

5/ Net returns from the sale of beet sugar by processors. Receipts minus excise tax, delivery and other marketing expenses.

6/ Preliminary. Raw sugar prices and refined sugar wholesale prices for 10 months and retail prices for 9 months.



The increase in the price of sugarbeets received by growers from processors, and the returns reported by sugarbeet processors as the basis for payment for beets, have both been lower, since 1953, than the increase in the average retail price of sugar.

The difference in price movements in the northeastern States and in the West and Midwest are largely the result of the increased marketings of beet sugar relative to total sugar sales in the United States. This has made it necessary for sellers of beet sugar to accept lower prices, relative to prices in the rest of the United States, in order to increase their volume of sales in western and midwestern States, primarily at the expense of other groups marketing sugar in those States, or to incur increased changes for transporting an increasing proportion of their sugar to distant markets. The available statistics show that beet-sugar processors have used each of these procedures, but that increased selling efforts, largely in the form of price competition in the midwestern States, has accounted for most of their increased sales.

A comparison of the percentage share of the retail price received by farmers for beet sugar and for all farm foods shows that the proportion received by farmers has been declining gradually since 1948.

### Corn Sweeteners

The influence over sugar prices in the United States exercised under the sugar quota law does not affect directly the prices of corn sweeteners or noncaloric sweeteners. However, since these products are sold largely in competition with sugar their competitive position is affected by what happens to the price of sugar. The stability of sugar prices in most years since World War II has doubtless contributed considerably to the stability of the prices of other sweeteners, especially corn sirup and dextrose. However, as previously shown, the trend in the prices of corn sweeteners has been downward in relation to the price of sugar. The fact that U.S. sugar prices have generally trended upward has doubtless contributed to the ability of cornsweetener producers to reduce their prices relative to prices of sugar.

The wholesale price of corn sirup in New York, converted to a dry-weight basis, averaged 0.44 cent per pound above refined sugar in 1955 (fig. 3). In 1964, as a result of a 2.09 cents per pound increase in the price of sugar and an increase of only 0.34 cent for corn sirup, the price of corn sirup was 1.31 cents below the price of sugar. This is a change of 1.75 cents per pound in 9 years and is equal to 20 percent of the 1955 price of sugar. The price of dextrose, which was 0.74 cent per pound below sugar in 1955, was 0.95 cent below in 1964.

### Noncaloric Sweeteners

The relation of the price of noncaloric sweeteners to the price of sugar is much less clear than that for corn sweeteners. The noncaloric sweetener now used in greatest volume, cyclamate, first marketed in the 1950's, largely as a specialty item. Recent reductions in the price of cyclamate appear to have been largely the result of increased domestic production and larger imports, and to have had little relation to the price of sugar. However, the growing use of these sweeteners increases their importance as competitors of sugar, and the relative costs of sugar and noncaloric sweeteners are becoming more important to various industrial users.

The wholesale price of calcium cyclamate has been reduced by stages from \$2.95 per pound in 1958 to \$0.64 per pound in 1965. The price of saccharin in the United States increased from \$1.40 per pound in 1960 to \$1.60 in the early months of 1964, but later dropped back to \$1.40. Since saccharin is about 10 times as sweet as the cyclamates, its price per unit of sweetening power is much below that of the cyclamates.

## PROSPECTS FOR THE SWEETENER INDUSTRY

Current conditions in the sweetener industry indicate that the recent upward trend in the consumption of noncaloric sweeteners is likely to continue for some years, although the rate of growth may decline. The growth in the consumption of corn sirup and dextrose, which has been evident since World War II, shows no sign of declining but appears likely to continue. Sugar consumption in the United States, which was increasing at approximately the same rate as the growth of population, has shown little evidence of any increase since 1962. Future increases in sugar consumption may be much smaller than in the 1950's.

The extent to which the increased consumption of nonsugar sweeteners represents overall growth in the size of the sweetener market rather than a substitution of other sweeteners for sugar is unknown, but it is nevertheless a matter of great importance to producers of all kinds of sweeteners and to many industrial users of these products. The three principal groups of sweeteners possess certain common characteristics, but each also has certain qualities the others lack. These differences make each sweetener better adapted to certain uses than any of the others, but their similarities make substitution possible in many other uses.

The uses made of noncaloric sweeteners until about 5 years ago, as well as the relatively small quantity consumed, suggest that there was little substitution between sugar and the noncaloric sweeteners. However, the rapid increase in the use of these sweeteners, together with the wider range of products in which they are used, suggests that they have increasingly become substitutes for sugar. Also, recent sharp declines in the price of noncaloric sweeteners, which make them cheaper per unit of sweetness than sugar, have made them more competitive.

The situation for corn sirup and dextrose is similar to that of the noncaloric sweeteners, although the changes have been more gradual and a considerable part of the apparent substitution of corn sirup, in particular, for sugar has been in the form of mixtures of liquid sugar and corn sirup.

The demand for sugar in the United States has been generally recognized as quite inelastic (changes in prices have little effect on the quantity consumed). However, the increasing use of other sweeteners as substitutes for sugar makes it easier for consumers to vary the quantity of sugar they use in response to price changes, since this can now be done with little or no change in the sweetness of the product.

This effect is likely to be more pronounced for sweeteners used by industrial food processors than for sweeteners used in household consumption. The relative cost of sweeteners is part of the expense of doing business of a commercial food processor and is likely to be watched more closely than in most households. Also, the knowledge and facilities needed in changing sweeteners are more likely to be available to industrial users. The proportion of the sugar consumed in the United States which is used by industrial food processors has been increasing for many years, and this trend shows no signs of ending. This situation increases the possibilities of substitution among sweeteners and should lead to more effective competition.

The corn sweeteners appear to be less vulnerable than sugar to market losses through displacement by noncaloric sweeteners. Sweetness is of much more importance for both sugar and noncaloric sweeteners than it is for corn sirup or dextrose. Consequently, corn sweeteners tend to be used in products where their properties other than sweetness are of special value and users are less likely to substitute noncaloric sweeteners--whose dominant characteristics are sweetness and no nutritive value--for them.

Trends toward the increased industrial use of sugar, increased deliveries of sugar in bulk, and increasing use of blends of sugar and corn sweeteners seem likely to continue so long as consumers in this country continue to become more urbanized and more dependent on convenience foods of all sorts.

The overall prospect is that sugar will continue for some years to lose part of its dominance as a sweetener in the United States. However, for the market as a whole it is likely to remain the most important sweetener in the United States for the foreseeable future.

## SUMMARY

The sweetener most widely used in the United States is sugar, but as its price has risen relative to that of other sweeteners, some of its share in the market has been taken by corn and noncaloric sweeteners.

The United States produces, from sugarcane and sugarbeets, more than half the sugar consumed in the country. The number of growers has decreased somewhat since 1956, but acreages and production have increased substantially.

Improvements in sugar processing have been introduced, they have been gradual, and the basic character of the operations has not changed.

Cane-sugar refineries are almost all in port cities--the largest volume of production and the greatest number of plants are in the area from Baltimore to Boston. Sugarbeets, grown mostly west of the Mississippi, are processed near where the beets are grown.

Prices for sugarcane and sugarbeets reflect both the sucrose content of the beets and cane, and the market price of sugar. The grower's share of the amount paid by consumers in retail stores declined in recent years, but not as much as the average for all foods.

Corn sirup and dextrose are sweeteners produced mainly from cornstarch; their use has increased since World War II. During 1948-65, the quantity of corn sirup sold in the United States more than doubled; dextrose sales increased 42 percent, and sugar sales, 34 percent.

The principal noncaloric sweeteners are chemical products: saccharin, cyclamate, and blends of these products. Cyclamate was introduced to the market as a sweetener in the early 1950's. Its use has grown, and it has become an important competitor of sugar, especially in the soft-drink industry.

The geographic pattern of prices for cane and beet sugar changed markedly in 1963-64. As raw cane prices rose in Atlantic ports, beet-sugar shipments to the northeast increased. Refined cane-sugar prices were higher in the New York area than in any other area in the country for both years, because of the influence of high prices in the world sugar market.

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